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Economic Impact of Using Tribufos Replacements On Cotton Yield and Market Value of the Fiber

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Tribufos is critically important to the U.S. cotton industry. The National Cotton Council's previously submitted statement of benefits (copy attached) stated that restricting the use of tribufos or removing the product altogether would obviously create a huge void in our industry's ability to prepare the crop for timely and efficient harvest. Tribufos based products (Def/Folex) is one of several harvest aid products used alone or in combination with other products to achieve effective preparation of the crop for harvest. Even with available tools, undesirable or incomplete defoliation and crop preparation often occurs. Producers need flexibility through product choices so that the most effective treatments can be put together to achieve effective defoliation under the crop and weather conditions at the time of application. Dr. Harold Coble has recently provided to EPA an analysis of cost of product replacement. His analysis shows a $28 million dollar impact on cotton producers based solely on product cost differential. This document is an economic analysis focusing only on losses to yield and fiber quality as a direct result of using products other than tribufos for cotton harvest preparation.

Role of Harvest Aid Products in Getting Crop Ready to Harvest

Crop yield and quality are at high risk during the time the mature crop is in the field awaiting harvest. With weather and crop condition (growth stage, maturity, senescence, etc.) difficult to either predict or evaluate, effective and timely preparation of cotton for harvest is critically important to maintaining crop value. This entails effective removal of leaves, retardation of regrowth, and promotion of boll opening in order to achieve timely harvest. Chemical harvest aid products such as defoliants, desiccants, and boll openers like Prep (ethephon) are essential in achieving these objectives. Harvest preparation must be carefully scheduled to coincide with availability of harvesting equipment and a favorable 10 to 14 day weather outlook. Cotton harvest in the U.S. is highly mechanized with large farms and limited harvesting capacity (especially pickers). Additionally, the harvest window (September and October in the mid-south) is short and weather during this period is highly variable and very unpredictable. Cotton losses in yield and quality can be significant. Parvin (1992) concluded in an economic analysis of the importance of harvest date that one week early in harvest initiation increases profits by 30 percent, while one week late decreases profits by 63 percent and two weeks late drives profits negative.

Prior to ginning, harvested cotton is held in high-density modules for a few days up to a few months in the field or on the gin yard. To preserve quality during storage in modules, seed cotton must be kept at low moisture levels and monitored closely. Excess leaf and plant trash, especially green leaves, are detrimental to crop quality. Severe discounts are applied to cotton bales that contain leaf trash, or stains caused by green leaf trash or high moisture conditions during storage. Effective harvest preparation with harvest aid chemical products including defoliants, desiccants,

and boll opening agents is critical in preserving the quality of the cotton and avoiding discounts such as those illustrated above.

Role of Cotton Quality in Establishing Market Value of the Crop

Cotton producer gross income is generated by the yield of cotton (pounds per acre) and by market value of the crop as determined by grade of the fiber. Yield is largely established during the growing season. However, quality of the fiber is easily affected by weather, preparation for harvest and by harvesting conditions. The economic importance of delivering high quality lint only continues to increase because recent changes in the USDA classification system for cotton fiber evaluation have placed greater emphasis on harvesting cotton free of trash and color pigmentation. Trash, as measured by High Volume Instruments (HVI), is the non-lint material in a ginned cotton sample. HVI color or the USDA class grade is the degree of light reflectance and yellowness of the cotton fiber. Contact of the cotton fiber with grass or weeds and the cotton plant leaves are two of the several factors that can contribute to discoloration of the cotton fiber.

Cotton is generally not thought of as a perishable crop, but fiber quality, especially color and trash content, is highly vulnerable during periods of inclement weather. Green leaves or regrowth at picking time can have dramatic effects on fiber quality and is normally discounted at the USDA classing office because of leaf trash, color stains, and fiber discoloration. For reference, we have enclosed is a CCC Loan Premium and Discount Schedule for US upland (short staple) and ELS (extra long staple) cotton for the 2000 crop year. In this schedule, everything is compared to a base quality, shown as BASE on the CCC schedule. If the bale is superior in quality, a premium is given to that bale. If quality is less than base, then discounts are placed on the bale. Premiums and discounts are shown as "points" with 100 points being 1 cent/lb. For example, 145 points would be a 1.45 cent/lb. premium while a -755 points would be a 7.55 cent/lb. discount.

Economic Analysis Focusing on Yield and Fiber Quality Losses

The following is an economic analysis focusing only on losses to yield and fiber quality. Since Dr. Harold Coble has previously submitted an analysis (copy attached) of replacement product cost differential, we will assume that EPA acknowledges the $28 million impact based upon his analysis. Our analysis will give estimates on the impact of replacing tribufos as a defoliant. Tribufos is normally used with another product such as ethephon to hasten boll opening which facilitates earlier cotton harvest or another defoliant that has better inhibition of regrowth, which may caused grade reductions.

Assumptions:
This analysis is largely based on making assumptions on how producers would make certain choices in preparing their crop for harvest in absence of tribufos products. We have developed scenarios to help estimate the possible impact on cotton yields, cotton grades and market value of the crop.

We have assumed that the 5 year average of 14.5 million acres of cotton are planted and that tribufos is used on 30% or 4.35 million acres of that production (1998 USDA ERS NASS "Agricultural Chemical Usage – 1998 Field Crops Summary AG CH 1, 99). We have used 650 lbs. (1.35 bales/acre) as the average yield of cotton per acre so 5.9 million bales of the total US cotton crop could be impacted annually as a result of replacing tribufos.

Questions:
How will the 4.35 million acres be prepared for harvest without tribufos?
What will be the potential for yield and quality losses because tribufos alternatives are used?
What is the estimated economic impact of using tribufos replacements?

Scenarios:
We have envisioned that the crop previously treated with tribufos (30% of the US crop or 4.35 million acres) would be impacted in the following scenarios. One is the impact during an ideal year where weather conditions are highly favorable. The second scenario is a typical or average year in which the defoliation and harvesting season is frequented by cool periods and unpredictable rainy periods.

Ideal Harvest Year

The best scenario would be an ideal year that would allow the crop to mature on schedule or even ahead of schedule and weather during defoliation season would be with limited or no rainfall and warmer than normal night temperatures. The harvest season would be warmer than average and limited interruptions because of rainfall. Harvest season would be completed without regrowth problems, rainy weather or weather related delays. This type of year is an event that is expected not more than once in every 10 years (Dr. Charles E. Snipes, Personal Communication, August 2000).

In an ideal harvest situation, we would expect that as much as one half of the crop (2.17 million acres) would be defoliated without difficulty and that cotton quality would not be significantly impacted.

It is estimated that the remaining one half of the acres previously treated with tribufos (2.17 million acres) would experience low to moderate quality damage as a result of weathering and green leaf stains caused by incomplete defoliation. Because of the unreliable performance of tribufos alternatives in cool weather and the frequent occurrence of such weather events, especially in the northern most regions of US cotton production, this scenario has a high probability of an annual occurrence (Dr. Bobby Phipps, University of Missouri, Personal Communication, August 2000). It is anticipated that cotton fiber discounts would be in the low to moderate ranges. The calculations below describe one half of the 2.17 million acres of cotton in this scenario (1.09 million acres), would average a low level of quality discount and the remaining half, 1.09 million acres, would average a moderate discount due to increased leaf trash and minor color discounts.

Table 1. Impact of using tribufos replacements in an ideal year.

Points	**# Acres**	**# Bales**	**Cents per lb.**	**$ per Bale**	**$ Impact (millions)**
-350	1,090,000	1,471,500	3.5	17	25.02
-750	1,090,000	1,471,500	7.5	36	52.97
			Total Impact on Quality		**77.99 million**

Typical or Average Year

A typical year is described as a fall weather pattern with fluctuating unpredictable warm & cool periods and variable rainy periods. We have envisioned that the 4.35 million acres of the cotton crop previously treated with tribufos would be impacted in the following scenarios:

1) One half of the 4.35 million acres (2.17 million acres) previously treated with tribufos will use other products, which are typically more expensive and less effective, with **little or no** effect on yield or crop quality (other than cost differential). Alternatives will require higher use rates and multiple applications of remaining products to achieve the same result as a lower use rate of tribufos combined with another harvest aid.

2) One fourth of the 4.35 million acres (1.09 million acres) will encounter cool weather and use of other tribufos alternatives will result in incomplete or poor defoliation leaving green leaves on the plant. As explained previously, even in an ideal year, the unreliable performance of tribufos alternatives in cool weather and the frequent occurrence of such weather events, especially in the northern most regions of US cotton production, this scenario has a high probability of being an annual occurrence. It is estimated that the impact would be exactly as described in the ideal year scenario, but with one fourth of the acres (1.09 million) being at risk. So cotton from this 1.09 million acres would experience low to moderate quality damage as a result of weathering and green leaf stains caused by incomplete defoliation. Fiber discounts would be low to moderate. The calculations below describe one half of the 1.09 million acres of cotton in this scenario (544,000 acres), would average a low level of quality discount and the remaining half, 544,000 acres, would average a moderate discount due to increased leaf trash and minor color discounts.

Table 2. Impact of incomplete or poor defoliation on cotton quality.

Points	# Acres	# Bales	Cents per lb.	$ per Bale	$ Impact (millions)
-350	544,000	734,000	3.5	17	12.5
-750	544,000	734,000	7.5	36	26.4
			Total Impact on Quality		**$38.9 million**

3) Another one eighth of 4.35 million acres (544,000 acres; 734,000 bales) will be forced to use a desiccant or an additional application of a defoliant to dry or remove leaves left on the plant in the event of unsatisfactory defoliation. Typically, desiccants should be avoided in spindle-type harvests. A desiccant will kill the leaves remaining on the plant, which is undesirable. Desiccated leaves stay attached to the plant and interfere with the harvesting procedure. Cotton picker action causes dry, desiccated leaves to shatter which contributes significantly to leaf trash in the harvested product. This trash is very difficult to remove at the gin and results in higher levels of leaf trash (leaf) in cotton grades. Alternatively, this results in increased ginning costs to remove as much of the trash as possible. Following an unsuccessful first attempt with another defoliant increases costs. Without tribufos, there is no suitable defoliant that will perform adequately without some degree of desiccation. To estimate the impact of this scenario, 272,000 acres (367,000 bales) would average increased leaf discounts amounting to 6 cents or $28.80 per bale. The remaining 272,000 acres would be more

severely impacted with average discounts amounting to 10 cents per lb. or $48 per bale. The calculations are shown in the table below.

Table 3. Impact of trash content on cotton quality.

Points	# Acres	# Bales	Cents per lb.	$ per Bale	$ Impact (millions)
-600	272,000	367,000	6	28.80	10.6
-1000	272,000	367,000	10	48.00	17.6
			Total Impact on Quality		**$28.2 million**

There are estimates of increased ginning costs and associated lint yield loss due to elevated trash levels. This may be an additional $15 to $30 per bale. Also, fiber quality loss can suffer under these ginning conditions of higher heat and more aggressive fiber cleaning (using three lint cleaners rather than two) which would result in fiber breakage. Discounts are for fiber uniformity as shown on the loan and discount schedule. We have not attempted to estimate the economic impact of the ginning costs nor the discounts because of uniformity, but the economic impact would be significant.

4) The final eighth of 4.35 million acres (544,000 acres; 734,000 bales) will be forced to delay harvesting operations and will suffer significant yield and quality losses because of prolonged periods of inclement weather during harvest. Harvesting delays would be caused by producers having to deal with cool weather that slows crop maturation and would delay defoliation applications. Days suitable for working the field (picking operations) diminish as the season progresses into the rainy fall season. As a result, fewer acres can be harvested per day exposing more of the crop to prolonged periods of inclement weather. Without tribufos, growers have no suitable alternatives during these periods of poor late season weather that is as effective and inexpensive as tribufos. Estimates are that 272,000 acres (367,000 bales) would get by with low levels of yield loss (2 to 4%). However, fiber quality losses would be significant, averaging discounts of 1250 points or 12.5 cents per lb. The impact is shown in the table below.

Table 4. Impact on cotton yield and quality due to delayed harvesting operations because of delayed defoliation and prolonged periods of inclement weather during harvest.

Points	# Acres	# Bales	Cents per lb.	$ per Bale	$ Impact (millions)
-1200	272,000	367,000	12.5	60	22.1
			2 % yield loss:		$2 million
			Total impact:		$ 24.1 million

On the remaining 272,000 acres (367,000 bales) producers would encounter significant and prolonged rainfall events which would result in harvest delays, high levels of yield loss (5 to 10 %), and quality discounts due to color, trash and light spot grades. Also, a small percentage of the crop, less than 5% of the acres, would probably be abandoned and never harvested. In this worst case scenario, discounts could average 1500 points in discounts. Yield loss is estimated to be 5% which is a $5 million impact and abandoned acreage is estimated to be 5% with a $ 5.3 million dollar impact.

Table 5. Impact on cotton yield and quality due to worst case scenario of delayed harvesting operations because of delayed defoliation and prolonged periods of inclement weather during harvest.

Points	# Acres	# Bales	Cents per lb.	$ per Bale	$ Impact (millions)
-1500	272,000	367,000	15	72	23.9
			5 % yield loss:		$5.0 million
			Abandoned Acres		$5.3 million
			Total impact:		$ 34.2 million

Impact of Additional Treatments

We can confidently predict that there will be a higher incidence of acres needing a second treatment with harvest aid products to get more complete defoliation (Dr. Charles E. Snipes, Personal Communication). This is difficult to cost out, but we have assumed that 15% of the 4.35 million acres (585,000 acres) would be treated a second time at an additional cost of $6.00 per acre. Dollar impact is $3.5 million due to material and application costs. There is also environmental impact because of additional chemical application required.

Summary

Tribufos is critically important to the U.S. cotton industry. Tribufos is one of several harvest aid products used alone or in combination with other products to achieve effective preparation of the crop for harvest. Even with available tools, undesirable or incomplete defoliation and crop preparation often occurs. Producers need flexibility through product choices so that the most effective treatments can be put together to achieve effective defoliation under the crop and weather conditions at the time of application. With the short harvest window and highly variable weather during this period, losses in yield and quality can be significant. This analysis substantiates Parvin's conclusion that one week early in harvest initiation increases profits by 30 percent, while one week late decreases profits by 63 percent and two weeks late drives profits negative.

This analysis (summarized in Table 6) provides estimates that the annual total impact on cotton yield and quality alone will be $77.99 million in an ideal year with favorable harvest season weather, and $124.4 million in a typical or average weather year.

Table 6. Summary of Economic Impact of Using Tribufos Replacements
On Cotton Yield and Market Value of the Fiber. National Cotton Council, August 2000.

SUMMARY TABLE		
Ideal Weather Year		
2,170,000 Acres	No effect	0
2,170,000 Acres	Low to Moderate Quality Losses (Table 1)	$77.99 million
	Total Impact on Quality in an Ideal Year:	**$ 77.99 million**
	Alternative Product Cost Differential Analysis (Coble):	**$ 28.00 million**
	Ideal Weather Year Total:	**$ 105.99 million**
Typical or Average Weather Year		
2,170,000 Acres	No Effect	0
1,090,000 Acres	Poor/Incomplete Defoliation (Table 2)	$38.9 million
544,000 Acres	Desiccation- High Trash (Table 3)	$28.2 million
544,000 Acres	Delayed harvest & inclement weather w/yield losses And abandoned acres (Table 4 - $23.1 M & Table 5 - $34.2 M)	$57.3 million
	Total Impact on Quality in a Typical Year:	**$124.40 million**
	Alternative Product Cost Differential Analysis (Coble):	**$ 28.00 million**
	Typical or Average Weather Year Total:	**$ 152.40 million**

Obviously, use of tribufos replacement products would create a huge void in our industry's ability to prepare the crop for timely and efficient harvest. Our estimate shows that this would cost US producers $124.4 million dollars in lost revenue annually. Coupled with Dr. Coble's analysis, replacement products will cost producers an extra $28 million. This increases the total impact of using replacement products to $152.4 million in an average year or $ 105.99 million in an ideal weather year.

References

1. USDA ERS National Agricultural Statistics Service - Summary of Tribufos use on Cotton in the US
2. Dr.Charles E. Snipes, Mississippi State University, Personal Communication, August, 2000.
3. Dr. Bobby Phipps, Cotton Extension Specialist, University of Missouri, Personal Communication, May, 2000.
4. Dr. Harold Coble, Benefits of Tribufos in Cotton Production in the United States. Letter to Anne Overstreet US EPA June 26, 2000 (Attached)
5. Uniform Harvest Aid Performance and Fiber Quality Evaluation, Cotton Defoliation Work Group Research Report - 1992-1996 Mississippi State University Information Bulletin 358, September 1999.
6. Parvin, D. W. 1992 The Importance of Harvest Initiation Date. Proceedings Beltwide Cotton Conferences. pp 471-474.

7. National Cotton Council Benefits of DEF/Folex (tribufos) in Cotton. Letter to Anne Overstreet US EPA March 6, 2000 (Attached).
8. 2000 Crop CCC Loan and Discount Schedule for Upland and ELS Cotton (Attached)